

## Urinalysis

### Cloudy/milky

- Phosphaturia (commonest – crystal precipitate in high pH)
- Pyuria
- Chyluria

### Red

- Hematuria
- Hemoglobinuria/myoglobinuria
- Anthrocyanin in beets and blackberries
- Chronic lead and mercury poisoning
- Phenolphthalein (in bowel evacuants)
- Phenothiazines
- Rifampin

### Orange

- Dehydration
- Phenazopyridine (Pyridium)
- Sulfasalazine (Azulfidine)

### Yellow

- Normal
- Phenacetin
- Riboflavin

### Green-blue

- Biliverdin
- Indicanuria (tryptophan indole metabolites)
- Amitriptyline (Elavil)
- Indigo carmine
- Methylene blue
- Phenois (e.g., IV cimetidine [Tagamet], IV promethazine [Phenergan])
- Resorcinol
- Triamterene (Dyrenium)

### Brown

- Urobilinogen
- Porphyria
- Aloe, fava beans, and rhubarb
- Chloroquine and primaquine
- Furazolidone (Furoxone)
- Metronidazole (Flagyl)
- Nitrofurantoin (Furadantin)

### Brown-black

- Alcaptonuria (homogentisic acid)
- Hemorrhage
- Melanin
- Tyrosinosis (hydroxyphenylpyruvic acid)
- Cascara, senna (laxatives)
- Methocarbamol (Robaxin)
- Methyldopa (Aldomet)
- Sorbitol

Variable	Normal value	High	Low
Specific gravity*	1.001 – 1.035	>1.020 Dehydration Diuretics DM	<1.008 Overhydration Impaired conc. DI
Urine osmolality	50 – 1200 mosm/l	As above	As above
pH	5.5 – 6.5	>6.5 Proteus RTA 1 and 2	<5.5 Cystinuria Uricosuria
Protein	< 20 mg/dl		

\* can be measured on dipstick/ osmolality cannot

### Haematuria

> 3RBCs/hpf suggestive of significant haematuria on microscopy

#### Dipstick testing

Detects haematuria, haemoglobinuria and myoglobinuria

Cells lysed on contact with reagent strip.

Peroxidase activity of haemoglobin/ myoglobin utilised vs. organic peroxidase substrate (orthotolidine).

Oxidation of chromagen substrate indicates presence of haemoglobin of myoglobin

Overall sensitivities 90-100% c.f. microscopy (2-5 rbc/ hpf)

[Woolhandler JAMA 1989]; Overall specificities 65-99% cf. microscopy

False positives:

Menstrual bleeding

Dehydration

Haemoglobin

Myoglobin

Oxidised reagent strips

False negatives:

Vitamin C

No studies directly compare dipstick positivity with presence of significant urological disease.

Incidence of urological malignancy with microscopic haematuria:

Asymptomatic overall ~ 0.5 - 2.0%

Asymptomatic > 50 yrs ~ 5%

Symptomatic > 50 yrs ~ 10%

Macroscopic haematuria ~ 25%

Screening for haematuria not recommended at present as PPV too low (0.5%)

NB. haematuria/RBC casts and proteinuria ( >100mg/dL or 2+) indicative of renal glomerular disease. Top 3:

IgA nephropathy (Berger's disease) 30%

Mesangioproliferative GN 14%

Focal segmental proliferative GN 13%

### Proteinuria

Normally 80-150mg protein excreted in urine per day

30% albumin; 30% globulin; 40% TH protein

Concentration rarely exceeds 20mg/dl (not detected on dipstick)

Dipstick contains tetrabromophenol – turns blue with albumin

Positive when protein conc > 20mg/dl

High specificity; low sensitivity

False negatives:

- High urinary pH

- Dilute urine

- Non-albumin proteinuria (Bence-Jones proteins in myeloma)

### Urine dipstick testing for UTI

Urinary nitrite and leukocyte esterase surrogates for bacteria and WBC respectively. Reference bacteruria >  $10^5$  orgs/ml

Early morning urine has increased sensitivity

Urinary Nitrite

- Dietary nitrates - urinary nitrates - nitrate reducing bacteria

- (enterobacteria) -urinary nitrites - react with amine-impregnated dipstix reagent - pink diazonium compound

- Sensitivity = 35-85%, Specificity = 92-100%

- False positives:

  - Contamination

- False negatives:

  - Non-enteric bacteria

  - Dilute urine/ frequent voiding

  - Vitamin C

  - High osmolality/ urinary H<sup>+</sup>

  - Urobilinogen

Urinary Leukocyte Esterase

- LE from neutrophil/ basophil granules reacts with reagent strip -

- indoxyl moiety produces colour changes by oxidation of diazonium salt

- Sensitivity = 72-97%, Specificity = 64-82%

- False positives

  - Specimen contamination

- False negatives

  - Old specimen (leucocyte lysis)

  - High osmolality/specific gravity

  - Vitamin C

  - Urobilinogen

When Nitrite and LE combined; Sensitivity = 70-100%, Specificity = 60-98%

### Glucose and Ketones

Double oxidation reaction: glucose – gluconic acid and hydrogen peroxidase – colour change

Very sensitive for any glucose in urine (corresponds to renal threshold of 180mg/dL)

Specific for glucose – not other sugars

Ketone testing specific for acetoacetic acid, not acetone or hydroxybutyrate

# Urine microscopy and culture

Clean catch MSU specimen

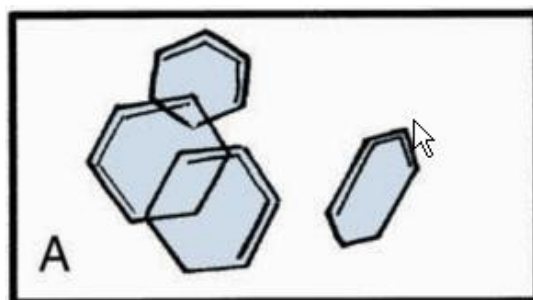
First voided morning specimen – examine within one hour

Centrifuged samples 5 mins at 3000rpm – resuspend

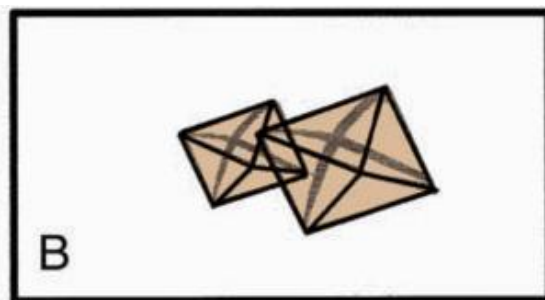
Examine at low power (100x) and high power (400x) 1 hpf = 1/20,000 ml

Routine examination for:

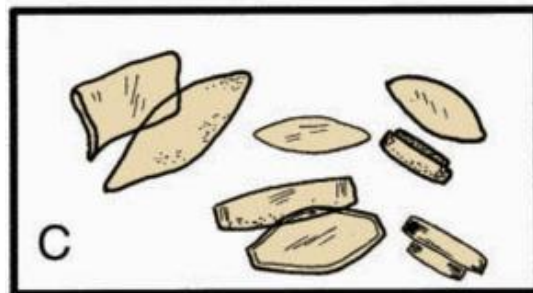
RBCs	Up to 3/hpf normal
RBC casts	Glomerulonephritis
WBCs	> 10wbc/hpf = significant inflammation
	1-2/hpf normal in men
	Up to 5/hpf normal in women
WBC casts	Pyelonephritis
Bacteria	5/hpf = 100,000/ml*



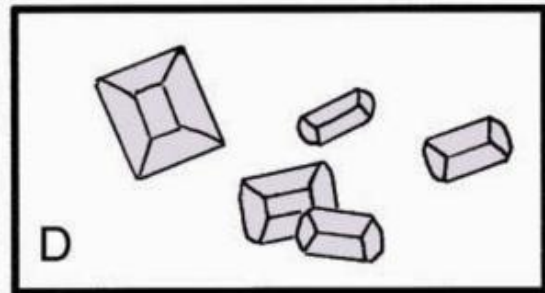
Cystine



Calcium Oxalate



Uric Acid



Triple-Phosphate  
(Struvite)